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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 2389250/GP/DR	FOR FURTHER ACTION	See Form PCT/IPEA/416
International application No. CT/AU2004/000045	International filing date (day/month/year) 14 January 2004	Priority date (day/month/year) 20 January 2003
International Patent Classification (IPC) or national classification and IPC Int. Cl. <sup>7</sup> A61B 5/0476		
Applicant [SWINBURNE UNIVERSITY OF TECHNOLOGY] et al CORTICAL DYNAMICS PTY LTD.		

- This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
- This REPORT consists of a total of 5 sheets, including this cover sheet.
- This report is also accompanied by ANNEXES, comprising:
- a. ☐ (sent to the applicant and to the International Bureau) a total of sheets, as follows:
- ☐ sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
- ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
- b. ☐ (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or table related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).
4. This report contains indications relating to the following items:
- |  |   |
|--|---|
| <input checked="" type="checkbox"/> Box No. I  | Basis of the report   |
| <input type="checkbox"/> Box No. II            | Priority  |
| <input type="checkbox"/> Box No. III           | Non-establishment of opinion with regard to novelty, inventive step and industrial applicability  |
| <input type="checkbox"/> Box No. IV            | Lack of unity of invention  |
| <input checked="" type="checkbox"/> Box No. V  | Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement |
| <input checked="" type="checkbox"/> Box No. VI | Certain documents cited   |
| <input type="checkbox"/> Box No. VII           | Certain defects in the international application  |
| <input type="checkbox"/> Box No. VIII          | Certain observations on the international application   |

Date of submission of the demand 30 July 2004	Date of completion of the report 2 May 2005
Name and mailing address of the IPEA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaaustralia.gov.au Facsimile No. (02) 6285 3929	Authorized Officer  MATTHEW FORWARD Telephone No. (02) 6283 2606

## INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.

PCT/AU2004/000045

## Box No. I Basis of the report

1. With regard to the language, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.
- ☐ This report is based on translations from the original language into the following language which is the language of a translation furnished for the purposes of:
- ☐ international search (under Rules 12.3 and 23.1 (b))
- ☐ publication of the international application (under Rule 12.4)
- ☐ international preliminary examination (under Rules 55.2 and/or 55.3)
2. With regard to the elements of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:
- ☒ the international application as originally filed/furnished
- ☐ the description:
- pages as originally filed/furnished
- pages\* received by this Authority on with the letter of
- pages\* received by this Authority on with the letter of
- ☐ the claims:
- pages as originally filed/furnished
- pages\* as amended (together with any statement) under Article 19
- pages\* received by this Authority on with the letter of
- pages\* received by this Authority on with the letter of
- ☐ the drawings:
- pages as originally filed/furnished
- pages\* received by this Authority on with the letter of
- pages\* received by this Authority on with the letter of
- ☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing.
3. ☐ The amendments have resulted in the cancellation of:
- ☐ the description, pages
- ☐ the claims, Nos.
- ☐ the drawings, sheets/figs
- ☐ the sequence listing (*specify*):
- ☐ any table(s) related to the sequence listing (*specify*):
4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
- ☐ the description, pages
- ☐ the claims, Nos.
- ☐ the drawings, sheets/figs
- ☐ the sequence listing (*specify*):
- ☐ any table(s) related to the sequence listing (*specify*):

\* If item 4 applies, some or all of those sheets may be marked "superseded."

**Box No. V** Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**1. Statement**

Novelty (N)	Claims 2-22, 25-26	YES
	Claims 1, 23, 24	NO
Inventive step (IS)	Claims	YES
	Claims 1-26	NO
Industrial applicability (IA)	Claims 1-26	YES
	Claims	NO

**2. Citations and explanations (Rule 70.7)**

The following documents identified in the International Search Report have been considered for the purposes of this opinion:

- D1 SCHACK et al (1995)\*
- D2 SCHACK et al (1995)
- D3 TSENG et al (1995)
- D4 BISHOP (2002)
- D5 BRUCE (2001)
- D6 US 5010891 (CHAMOUN)
- D7 US 5083571 (PRICHEP)
- D8 US 5797853 (MUSHA et al)
- D9 US 6067467 (JOHN)
- D10 DENG (2002)

The present application determines the state of a persons brain by processing eeg data using an autoregressive moving average and solving the z-domain polynomial to an 8<sup>th</sup> order autoregressive and a 5<sup>th</sup> order moving average to obtain a plot of poles in the z plane. The polar plot may be used to monitor brain function, thus determining an individuals alertness, response to an agent and their state of sleep. This concept is expressed most broadly in claims 1 and 23. Subsequent independent claims (3, 4, 7, 10, 18, 19, 20, 21, 22 and 25) define specific situations where this processing is used.

These claims define known z-transform formula (see document D4 and D5) being solved for the 8<sup>th</sup> and 5<sup>th</sup> order polynomials.

Documents D1 and D2 disclose exploring human cognitive processes by analysing EEG data using an autoregressive/moving average (ARMA) model. They recognise that for a sufficiently accurate fit of the signal to the model, the model order (p,q) must be established. They suggest that p+q should be in the range 9 to 20, and disclose p as being 15 (15<sup>th</sup> order autoregressive) and q as 5 (5<sup>th</sup> order moving average). It is considered that the polynomial order required is dependent on the quality of the EEG data (itself dependent on the quality of the equipment used to collect the data). Since it has been recognised that p+q should be in a range, the particular values of p and q are a matter of experimentation for a particular data set. The values of p and q disclosed in the present claims (8 and 5), obey the basic rule disclosed in documents D1 and D2. Arriving at values of p=8 and q=5 results from non-inventive experimentation and does not involve an inventive step. Claims 1, 23 and 24 lack an inventive step in view of either D1 or D2.

# INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.  
PCT/AU2004/000045

## Box No. VI Certain documents cited

### 1. Certain published documents (Rule 70.10)

Application No. Patent No.	Publication date (day/month/year)	Filing date (day/month/year)	Priority date ( valid claim) (day/month/year)
P,A US 6549804	15 April 2003	10 June 1999	23 January 1996

### 2. Non-written disclosures (Rule 70.9)

Kind of non-written disclosure

Date of non-written disclosure  
(day/month/year)

Date of written disclosure  
referring to non-written disclosure  
(day/month/year)

## Supplemental Box

case the space in any of the preceding boxes is not sufficient.

Continuation of: Box V

Document D3 discusses ARMA modelling of EEG signals and presents an equation (1) (see page 72) which is substantially the same as the "y(n)" equation defined in claims 3, 4, 7, 10, 18, 19, 20, 21, 22, 25. This document does not discuss z-transformation on the modelled EEG signal. Their results summarise testing a range of model orders and evaluation of their efficiency. Table 2 of D3 presents their results. It is clear that 8<sup>th</sup> order autoregressive and 5<sup>th</sup> order moving average are within the scope of their testing model orders. Claims 1, 23 and 24 lack novelty in view of this document.

Documents D4 and D5 are references to extracts from standard texts on Biomedical digital signal processing. They disclose the equations defined in independent claims 3, 4, 7, 10, 18, 19, 20, 21, 22 and 25 and using z-transforms to determine the poles. The instant application admits that a standard ARMA modelling and z-transform package is used to calculate coefficients according to the equations defined in the independent claims. The present claims define using standard techniques, known equations and obvious coefficients, to analyse EEG data for a known purpose. Claims 2 to 2 and 25 to 26 are considered to lack an inventive step in view of either D1, D2 or D3, in view of the common general knowledge as exemplified by documents D4 and D5. Claims 2 to 22 and 25 to 26 are all considered to lack an inventive step in view of either D1, D2 or D3 when read in the light of either documents D4 or D5.

Document D6 to D9 disclose using z-transformed EEG data to measure brain function in a various circumstances. Document D10 is a set of lecture notes cited to illustrate z-transforms in digital signal processing. None of these documents disclose the invention as defined in the instant case.

Claims 1, 23 and 24 lack novelty and do not satisfy Article 33(2) of the PCT. Claims 2 to 22 and 25 to 26 are novel, have an industrial application and thus satisfy Articles 33(2). Article 33(3) of the PCT is not satisfied, claims 1 to 26 lack an inventive step in view of the cited prior art. Article 33(4) of the PCT is satisfied, claims 1 to 26 have an industrial application.